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Concrete Highway MAGAZINE

Devoted to Concrete Roads, Streets & Alleys

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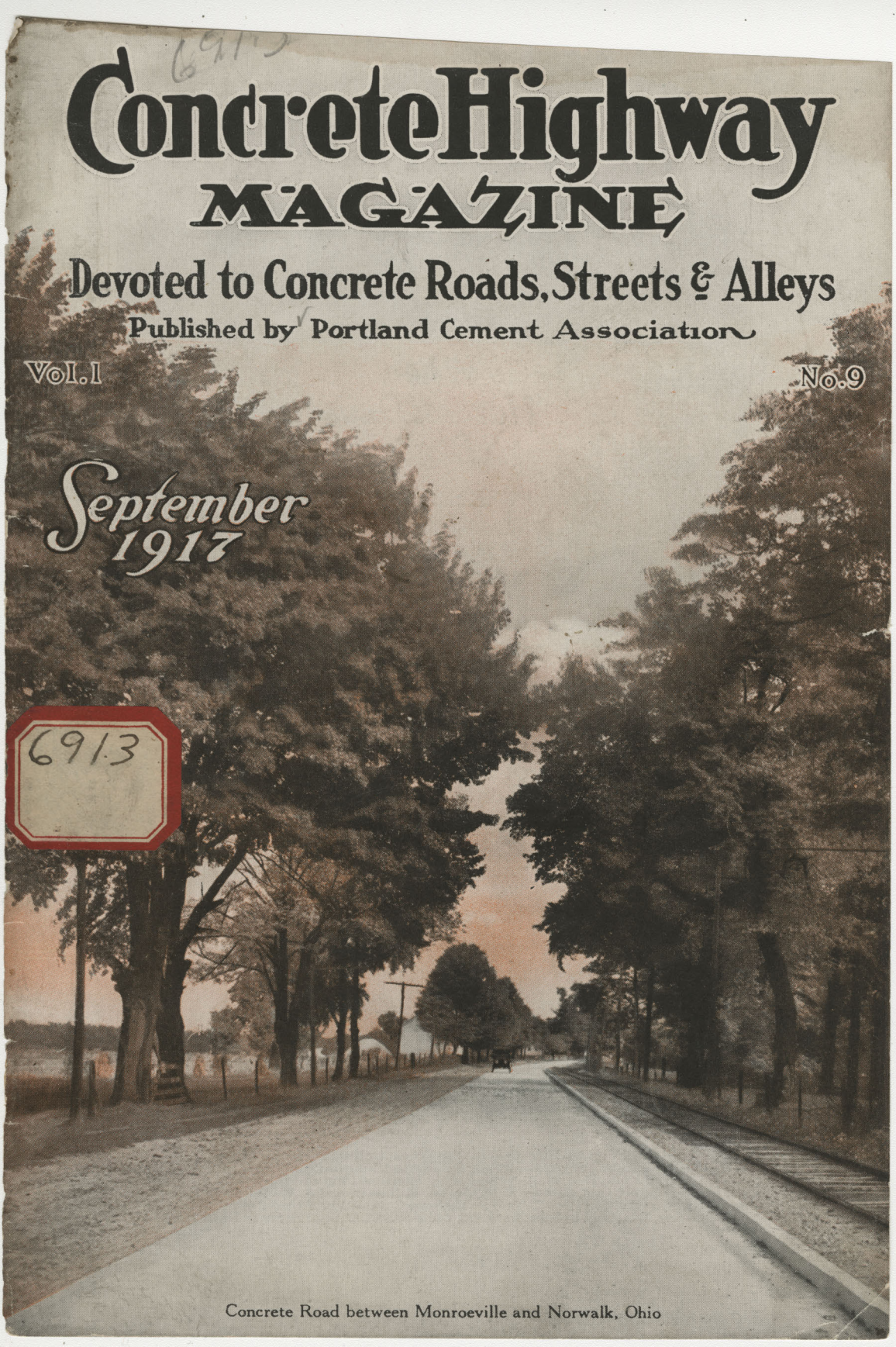
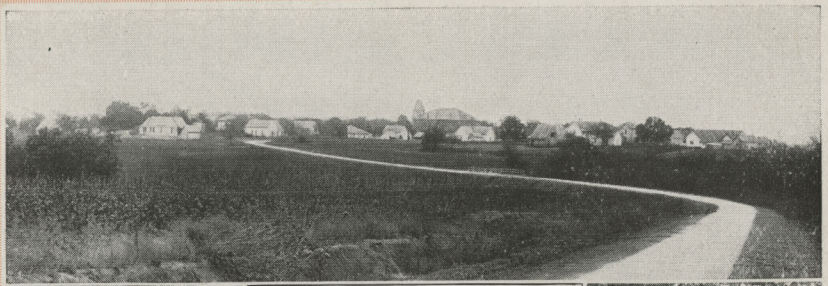


Concrete Road between Monroeville and Norwalk, Ohio



When Harvest Days Begin

THESE concrete roads are always clear for action—clean, hard, smooth and dependable—ready to meet increasing weight of traffic and putting town and farm in quick touch with each other. It costs money to build them, but it costs much more to do without them.

At top: Kingston-Salem road, Hunt County, Texas, built by Roach-Manigan Const. Co., Fort Worth, J. C. Field Engineering Co., Engineers. At left: Quaker road, Niagara County, N. Y., built by F. J. Mumm Const. Co., Inc., Buffalo, Thos. M. Brennen, County Superintendent of Highways, Niagara Falls. At right: Olcott-Lockport road, built by H. M. Cowles, Rochester, and A. W. Summers, Buffalo, W. M. Acheson, Division Engineer, New York State Highway Commission. At bottom: Lakeside road, Dane County, Wis., built by Nicholas Quinn, under Wisconsin State Highway Department

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111 West Washington Street, Chicago

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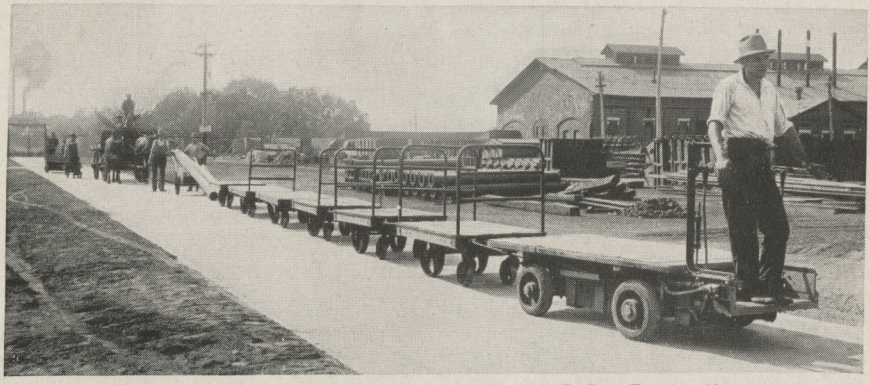


Traffic Passing over the Concrete Road, A. T. & S. F. Ry., Topeka, Kansas

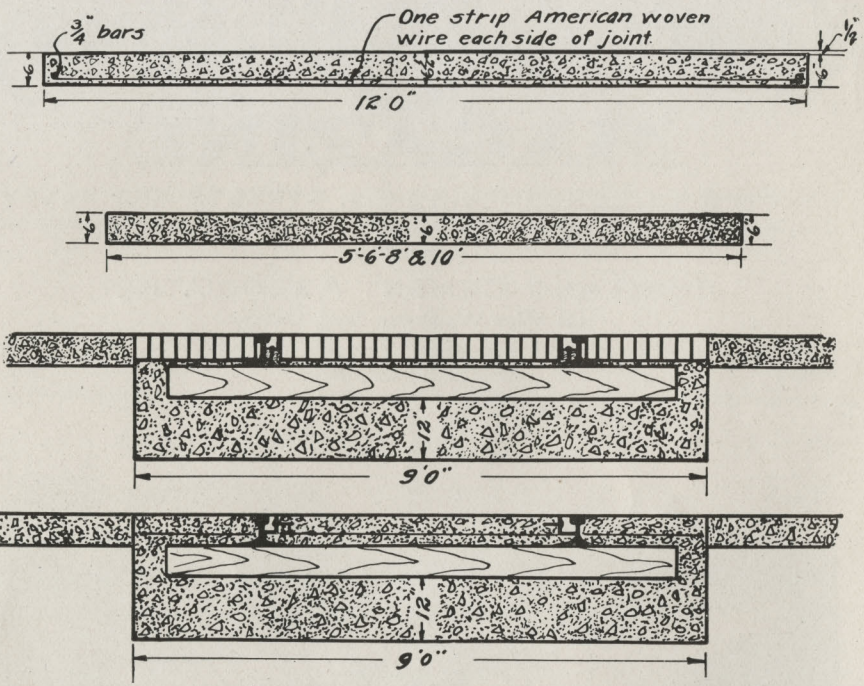
Santa Fe Railway Laying Concrete Pavement

By CON M. BUCK, C. E., Mem. A. S. C. E.
Division Engineer, Santa Fe Railway

THE Santa Fe Railway is constructing about two and one-half miles of concrete roadways of twelve, ten, eight and six foot widths in their shop and storehouse yards at Topeka, Kansas, to be used for trucking and hauling of storehouse supplies to and from storage and shops, also from shops and storage to cars for loading line shipments. The roadways will also serve as fire roads.

After making a study of the hauling and trucking conditions, which included a series of tests of the performances of an electric truck loaded and unloaded, with and without trailers under load, and moving over earth, oiled cinders, wood, and iron roadways, the store department found the greatest economy would result by the building of a system of concrete roadways. Accordingly, plans and estimates were submitted and authority was received to construct these roadways, consisting of 10,706 square yards of 12 foot widths, and 3,490 square yards of lesser widths, a total of 14,196 square yards of concrete, together with the 89 track crossings over main and switch tracks in the yards.

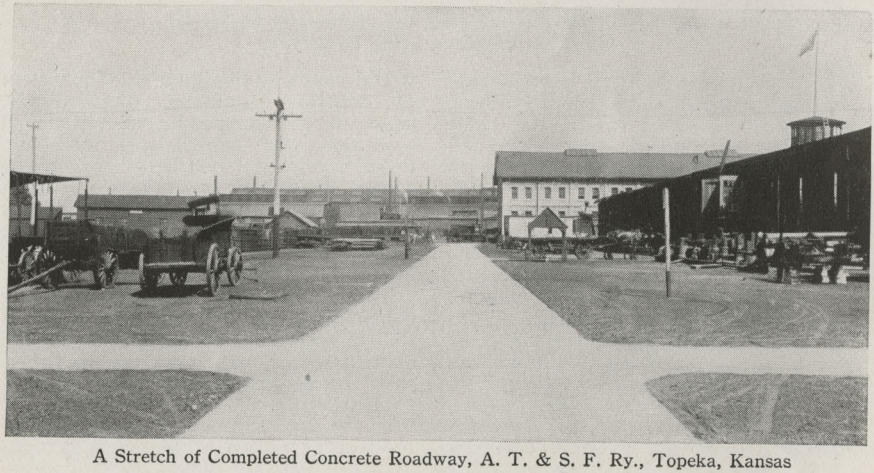
These roadways are being built by company forces. All side forms are set to line and grade as established by the engineering party. Any surplus dirt is then thrown out and subgrade dressed carefully to the bottom of the 2″ x 6″ used for side forms. As most of these roads are located where cinder roads



Sections of roadway and track crossings

now exist, there is a good firm subgrade which requires no tamping. Where possible, the excavated dirt is used against the shoulder and the excess is then carted away.

The roadways are of one-course construction 6 inches thick. Standard portland cement meeting specifications of the American Society of Testing Materials is used. The fine aggregate is clear, sharp Kaw River sand, taken from the river at Topeka and delivered at the work in cars. The coarse aggregates consist of clean crusher-run Garnett



A Stretch of Completed Concrete Roadway, A. T. & S. F. Ry., Topeka, Kansas

stone, one and one-half inch maximum size, from which all fine screenings have been removed. This rock is also delivered in cars.

The time of mixing is 1½ minutes and the mixer delivers the concrete to its position in the roadway, where it is evenly spread and struck off with a template, a ½" crown being given the surface and finished with a wooden float.

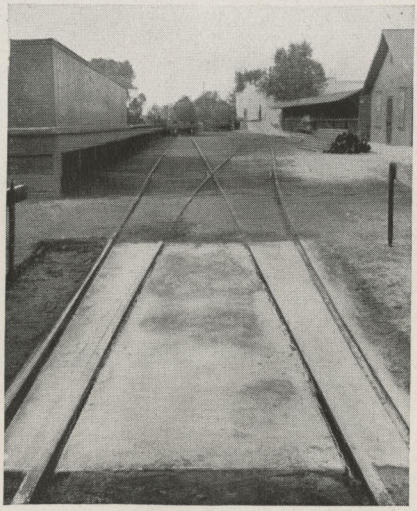
The slabs are reinforced and expansion joints are placed 30 feet apart, composed of two thicknesses of tar paper, held in place by a steel plate which is removed as soon as the concrete has been placed ten feet in advance of the joint.

Where side entering roadways are of materials other than concrete, an angle iron ⅜" x 2" x 2" is placed and anchored on the edge of the concrete roadway in such a manner as to protect the top corner from being broken away by the traffic.

Where the roadway crosses the main line the crossings are constructed with 12" of concrete upon which is placed a sand cushion and a brick surface. The flange ways are made by using angle iron of ⅜" x 2½" x 2½" section, the bottom leg resting upon the concrete blocking with its outer edge against the web of the rail. The angle is drifted to ties by bolts driven through holes drilled in the lower leg, thus giving a flange way of 1¾". On account of the small wheels on the trucks, it is very desirable to have as small a flange way as possible to lessen the jar to trucks and loads when passing over the crossings. On the side track crossings the construction is wholly of concrete. The angle irons for the flange ways are placed and anchored and woven wire reinforcement is placed between the flange way guards and outside the rails to the end of ties. The concrete is run to surface even with the top of rails. The details of this construction are shown in the drawing of the sections of roadway and track crossings.

As previously stated the work is being carried on by company forces and is under the supervision of W. C. Hunt, traveling storekeeper, to whom much of the credit for the adoption of concrete and for the careful execution of the work must be given, with H. Allison as foreman. The engineering field work is in charge of F. T. Morse, transitman.

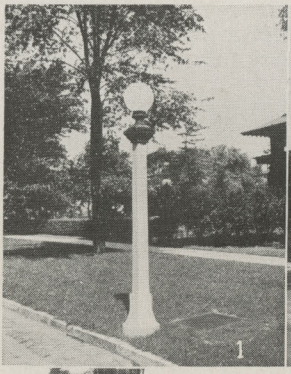
That portion of the work which is in service is highly satisfactory, and the character of the traffic passing over the roads can be seen in the photograph which shows electric trucks and trailers, hand trucks, and horse drawn wagons. Nine electric trucks are now in service, and the horse drawn wagons will be gradually supplanted as more trucks and tractors are being ordered.

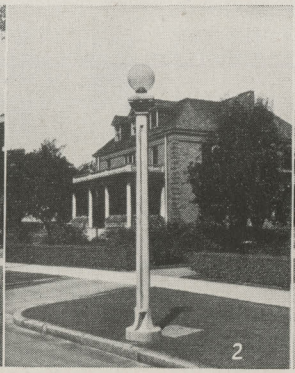


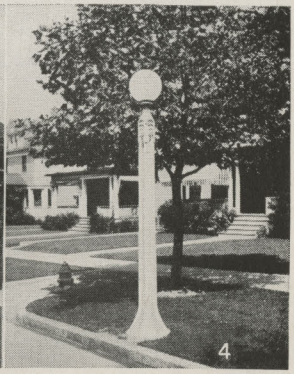
Concrete track crossing, showing flangeways

Bulletin on Illinois Highway Materials

BULLETIN No. 14 of the Illinois State Highway Department, prepared by F. L. Roman, testing engineer, gives a list of the sources of supply of road materials in Illinois and the territory adjacent. The materials listed are sand and gravel, crushed stone, paving brick, portland cement and miscellaneous materials. Shipping facilities for each source are listed and the concluding table is a list of railroads arranged alphabetically showing the material contained along the lines and location of the deposits, quarries or plants. Two outline maps are included on which the sand and gravel deposits and stone quarries are noted by circles enclosing numbers which refer to the description given elsewhere in the book.







Lighting Standards in Rochester

By RUDEN W. POST

Superintendent City Engineers' Laboratory Street Lighting, Rochester, N. Y.

CONCRETE lighting standards are giving satisfaction at Rochester. In 1910 the Rochester Railway & Light Co. began experimenting with lighting standards to get a less expensive ornamental pole for underground service lights in residence districts and for more permanent construction for their back lot lines. The first pole was 35 feet long, square, reinforced with four ½-inch round rods. Of the first three, two were set and are still standing. The other pole was broken in carrying. The new standards used were reinforced with ⅝-inch square, twisted bars and have stood up in a very satisfactory manner.

About a year ago the company began making hollow poles, using a taper core and in this way producing a stiffer pole of the same weight. At the present time something like half of the new poles are concrete and are used both in the streets and in the back lot lines, many of them carrying street lights, both arc and incandescent.

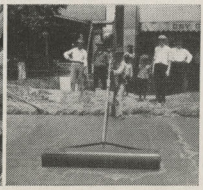
The first lamp posts for underground service were made during the summer of 1910. They were plain, square poles shown in Fig. 1, reinforced with four ½-inch round rods and a 2-inch pipe in the center to carry the wires and connect the subway. The cast iron cap at the top carries the globe and the concrete base was cast after the pole was set. This was added after a number had been set and greatly improved the appearance. The difficulty with these poles was in keeping the cast iron top painted so that rust did not streak the concrete.

This led to the one shown in Fig. 2, with a concrete cap and the base cast with the pole. It is reinforced in the same way but is a cross in section. By the end of 1911 about 250 of the first two designs were in use and are still standing.

In 1912 the pole shown in Fig. 3 was developed and used till the beginning of 1916, at which time we had about 3,000 of them in use. The difficulty with the iron coating was overcome by the use of a bronze casting at the top. The pole shown in Fig. 4 was first made in 1913 for use with a 4 ampere inverted magnetite lamp and later with a 600 c.p. and 1,000 c.p. Mazda lamp. In 1916 this pole was adopted as the standard concrete pole for all street lighting other than overhead service.

At the present time there are about 3,500 of these four types of poles on the residence streets of Rochester. We are now using the 16-inch globe for the 80 c.p. and 100 c.p. lamps and an 18-inch opal globe for 200 c.p., 600 c.p. and 1,000 c.p. lamps.

What's Doing



In Concrete Road, Street and Alley Building

CHICAGO—16,760 square yards of concrete alley work was let in the city Aug. 27.

STANWOOD, WASH.—Contract has been let for 2,180 square yards of concrete on Saratoga Street.

BETHANY, NEBR.—Roberts Construction Co. has the contract here for 11,200 square yards of concrete paving.

ROSEDALE, KANS.—Concrete will be placed on 6,850 square yards of streets in Rosedale this year.

SPRINGFIELD, MASS.—Fred Clarks, Superintendent of Streets, has completed paving Hayden alley with concrete.

KENWOOD, N. Y.—Chapel & Kenwood Avenues will be paved with concrete. Jos. B. Frazio of Oneida, N. Y., has the contract.

PLAINFIELD, N. J.—R. G. Bush of this city has the contract for paving 2,500 square yards of roadway for the Lozieaux Lbr. Co. of this city.

SEATTLE, WASH.—J. B. Romans, of this city, has the contract for 2,195 square yards of concrete to be placed on a heavy grade on Mount Claire Drive.

LEXINGTON, KY.—Phelps-Post-Guyn Co., this city, have the contract for paving Main Street, Jenkins Co. with concrete. Approximately 4,000 square yards is to be placed.

THE beginning of concrete construction in Dallas County, Texas, this year was made the occasion of a celebration by the officials of the county. The picture shows the start of the work on the West Dallas Pike, and the County Court and the County Engineer are on hand to give it the proper send-off. The officials of Dallas County are: Quentin D. Corley, County Judge; Jeff D. Bruton, County Commissioner; G. W. Ledbetter, County Commissioner; Jas. T. Miller, County Commissioner; W. J. Patrick, County Commissioner; and J. F. Witt, County Engineer.

CAMP MEADE, MD.—Three miles of 18-foot and 1 mile of 24-foot concrete paving is under contract here.

RIPLEY, W. VA.—James S. Chase, Engineer, is placing 4,822 square yards of concrete street paving here.

EDGEMERE, N. Y.—Concrete paving 30 feet wide is being placed on Lewnay Road, by A. Bodock, of Inwood, L. I.

KANSAS CITY, KANS.—Contracts for 24,193 square yards of street paving and 5,445 square yards of concrete alley work have been let here.

KOSCIUSKO COUNTY, IND.—Contract has been let for concrete on the Starner Road to Putnam & Shingledecker, covering a distance of 15,840 feet; 16 feet wide.

GOSHEN, IND.—Reith Construction Co. of this city has the contract for paving Truman, Adams Road in St. Joseph County. The work totals 16,512 square yards of concrete.

LAFAYETTE, IND.—H. B. Moore of West Lafayette, Ind., has the contract for paving the alley from Central to Kossuth Streets between 9th and 10th Streets with concrete. The alley is 1,223 feet long and 12 feet wide.

TOLEDO, OHIO—Contracts recently awarded here for concrete include Colburn Street, 2,978 square yards, to Peter H. Walters, Toledo, Ohio; Chase Street, 2,380 square yards, also to Mr. Walters; and an alley between Main and Euclid Streets, 599 square yards to Doan & Langendorfer, Toledo.

NEW YORK STATE HIGHWAYS—Contracts for concrete roads have been awarded including the Little Neck-Old Westbury Road, Nasau County, for 15,477 square yards to John McAvoy, New York City; Utica-Poland Road, Oneida County, 7,200 square yards to Harry W. Roberts & Co., Utica, N. Y.; East Islip-Smithtown Branch Road, Suffolk County, 89,824 square yards to the Robert W. Smith Corporation, New York City. These contracts will total 112,501 square yards.

SIOUX CITY, IOWA—Contracts for concrete paving recently awarded here include:

Alley in block 7—1,360 square yards to Krage & Jensen, South Street, Aubin Avenue—6th St. to Glenn St.—1,650 square yards to J. Overson.

Alley in Block 41—Sioux City East—430 square yards to J. Overson.

25th Street—Jones Street to Jackson Street, 700 square yards.

South Wall Street—Dace Street to Chicago Street, 2,112 square yards to Krage & Jensen.

Alley in Block 15—Higman's 2nd Addition —550 square yards—to J. Overson.

CHESTER, PA.—Bud Oliver of Chester has the contract for 2,000 square yards of paving here.

HAMMONDTON, N. J.—Placing of 15,900 square yards of concrete on Bellevue Avenue has been completed.

ERIE, PA.—Contract for paving Court Alley with concrete was let to L. G. Hain of Erie. The work amounts to 400 square yards.

LAKEWOOD, OHIO—A reinforced concrete pavement 3,160 square yards with integral curb will be placed on Clarence Avenue by B. G. Fay.

NORTH CHICAGO, ILL.—F. E. Ball & Sons of Hampshire, Ill., secured contract for 49,700 square yards of concrete paving.

SANDUSKY, OHIO—Contract for 17,950 square yards of concrete to be placed on Cleveland Avenue, Ninth Street and East Ninth Street Extension, has been given to John F. Gottran of Fremont, Ohio.

THE accompanying view shows a concrete sign post, adopted by the County Court, Dallas County, Texas. The details of the construction of this are given in the drawing: The post contains 4¼ cubic feet of 1:2:4 concrete and the following materials are required for construction: 0.95 sack cement; 1.91 cu. ft. sand; 3.82 cu. ft. gravel; 12 linear ft. 6 gauge wire; 20 linear ft. 12 gauge wire; 43 linear ft. ⅜ in. square twisted bars—20.55 lbs.

The post was designed by J. F. Witt, County Engineer, Dallas, Tex.

RIVERSIDE, ILL.—Riverside Drive is to be paved with concrete by William Ryan of Lyons.

NEW CASTLE, PA.—Woods & Golder have the contract for laying 2,486 square yards of concrete on Butler Avenue.

WAMPUM, PA.—Main Street will be paved with concrete. M. J. Scanlon, of New Castle, Pa., has the contract.

NAPERVILLE, ILL.—Logan & Giertz of Elgin, Ill., will lay 56,100 square yards of one-course reinforced concrete pavement here.

PORTSMOUTH, OHIO—Hogan and 22nd Streets will be paved with one-course reinforced concrete. The work amounts to 10,000 square yards.

EAST AURORA, N. Y.—The Meyer & Meyer Corporation of Depew, N. Y., have the contract for placing 11,100 square yards of concrete on Center Street.

MIDDLETOWN, OHIO—American Rolling Mills will pave Forrest Avenue with concrete. The work amounts to 21,177 square yards and will be done by force account.

CINCINNATI, OHIO—Scully Brothers, of this city, have the contract for concreting the Cincinnati-Hamilton Road in Hamilton County, Ohio, embracing 18,650 square yards.

EAST LIVERPOOL, OHIO—Penn, Harvey and Elizabeth Streets will be paved with concrete. The work covers 21,700 square yards and will be done by F. G. Wagner of Carrollton, Ohio.

MEADE, WASH.—Concrete for permanent highway No. 7-B, a section of the Meade-Newport Road north of here will be placed by H. C. Root of Spokane for one-course concrete, covering a distance of 2.67 miles; width 16 ft.

PASSAIC, N. J.—Franklin Avenue from the city line of Passaic to the town line of Nutley, N. J., will be paved with concrete by Fred Spatz, Jr. This will be an 8-inch reinforced concrete pavement of 7,700 square yards.

LYNN, MASS.—City forces are laying concrete on Oxford Street and Market Square. These streets are 36 feet wide and pavement has a uniform thickness of 6 inches. John Graham, Superintendent of Streets, has charge of the work.

ILLINOIS STATE AID ROADS—Contracts awarded for concrete so far this year total more than 97 per cent of the yardage awarded for the entire year of 1916. The total yardage of concrete awarded in 1916 on state aid construction was 316,520 square yards. From January 1 to July 31, 1917, there has been awarded 307,726 square yards. Contracts for concrete roads recently awarded include: Sections E, Bureau County, 14,000 square yards to Keokuk Quarry & Construction Co., Keokuk, Iowa; Section J, Bureau County, 14,334 square yards to Keokuk Quarry & Construction Co.; Section H, Route 4, Kankakee County, 9,200 square yards, to Goggin Construction Co. of Arcola, Ill.; Section D, Ogle County, 14,000 square yards to Drinnin & Clark, Galesburg, Ill. Contract for 18,000 square yards of concrete roads to be built in Denning Township, Franklin County, Ill., was awarded the Stocker Gravel & Construction Co. of Highland, Ill.

Concrete Guard Rails on Highways

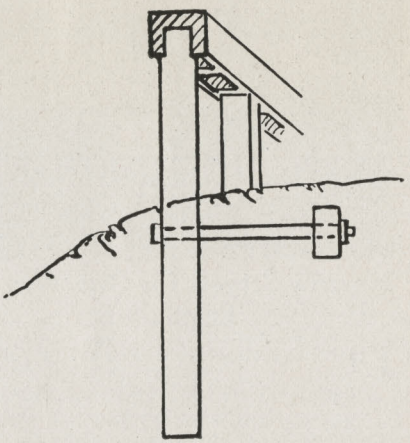
By GEORGE C. WRIGHT
Assistant County Engineer, Monroe County, New York

ON account of the great mileage of new highways now projected, the building of which is insured by the reorganization of State Highway Departments in co-operation with the Federal Aid Act, it is time to consider other features of road building aside from the construction of a hard surface.

J. Y. McClintock has devised a steel concrete guard rail which has been adopted as a standard of the New York State Highway Department. It has been erected on more than fifty improved highways in New York, Massachusetts, Pennsylvania, and also in New Jersey on the great automobile outlet of New York City across the Hackensack Meadows, where 25,000 feet of guard rail is rendering excellent service on the Belleville Turnpike.

The guard rail shown in the illustration which accompanies this article was erected under the direction of T. J. Wasser as County Engineer of Hudson County. It has proven satisfactory in every particular and has undoubtedly saved many lives. Traffic on this road is dense and includes a vast number of pleasure cars, as well as heavy trucks. Many times this rail has been struck by heavy vehicles and some 30 or 40 posts have been broken, but in no case has a machine gone through.

The anchor rods are three feet long, passing through each post at right angles with the axis of the road, and through a substantial concrete block two feet long, which is embedded in the ground on the highway side of the fence, thus effectively preventing the fence from being overdrawn by a blow of a machine.

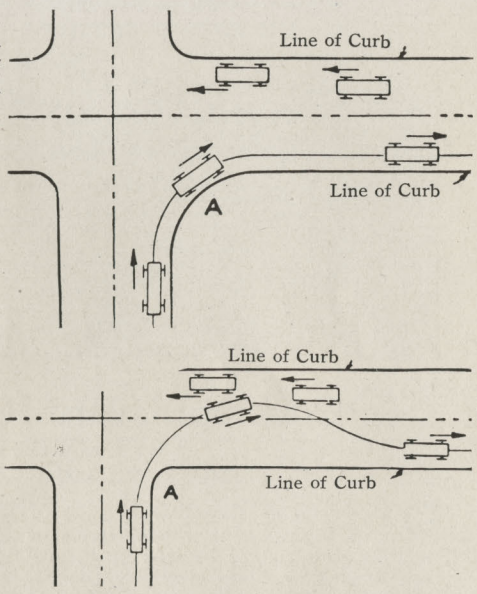


In Monroe County, where the people take a justifiable pride in the character of the large mileage of improved roads, this concrete guard rail is generally used.

Increasing Radius of Curves at Street Intersections for Safety*

A DEVELOPMENT in street improvement resulting from automobile traffic is the demand for curves of larger radius at the corner of street intersections. Past practice resulted in a corner that was nearly square, or had a curve varying from 4 to 10 feet radius. This means that the vehicle could not turn into an intersecting street until it had passed the corner. The driver of a car must either shift gear and slow down to a suitable speed for the turn, or else he may take the turn with an abruptness that is a menace to other vehicles as well as pedestrians.

A further alternative practiced by many drivers is to swing widely at the turns, a practice which carries them to the wrong side of the roadway and risks accident.



This picture shows a safe turn on Chestnut Street in Cameron, Mo., which was paved with concrete in 1916. Fessler Lawrence is the city engineer

Toronto, Ottawa, Windsor, Stratford, Chatham, and other cities in Ontario, are widening and rounding many of their street intersections. The increasing radius of the curves enables automobiles to follow a course paralled to the curb and keep on the right side of the roadway, with greater convenience and safety.

**From the report on Street Improvement of the Province of Ontario, by W. A. McLean, Deputy Minister of Highways.*

Narrow Streets for One-Way Traffic

TO relieve congestion on narrow and much used streets, an ordinance was passed at Toledo, Ohio, providing for one-way traffic on Huron and Erie streets, between Monroe and Jackson. Erie street will be used for traffic going south. Vehicles on these streets may stop at the curb on either side, instead of only at the right curb as on other streets.

Seattle Motor Traffic Grows 222 Per Cent

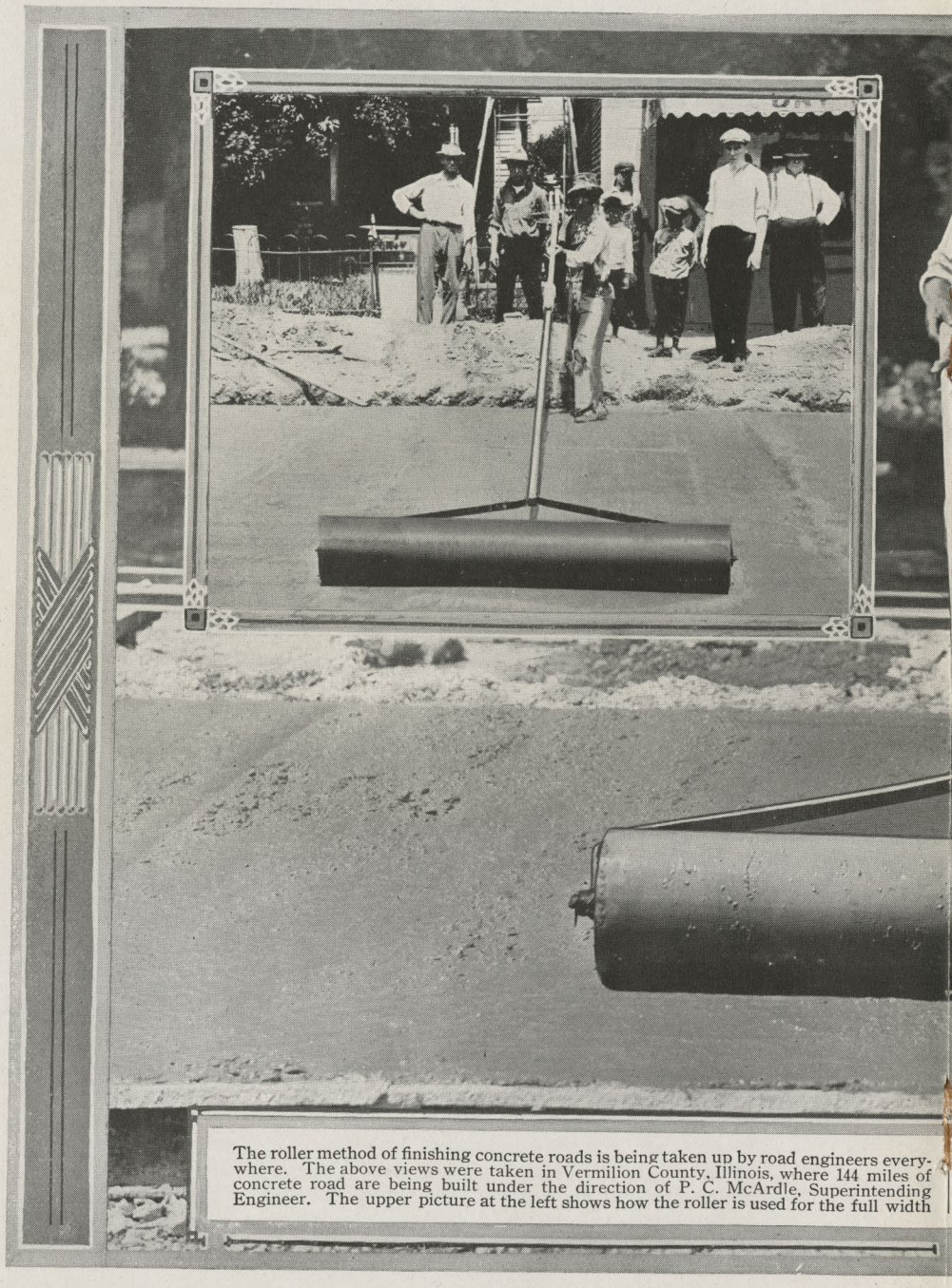
AN item in a recent issue of the Municipal Journal emphasizes the change which is taking place in our highway traffic.

An official traffic census taken in 1915 at seven points in Seattle, Wash., showed 17,568 motor driven vehicles as compared with 5,160 counted in the census of 1911, an increase of 222 per cent.

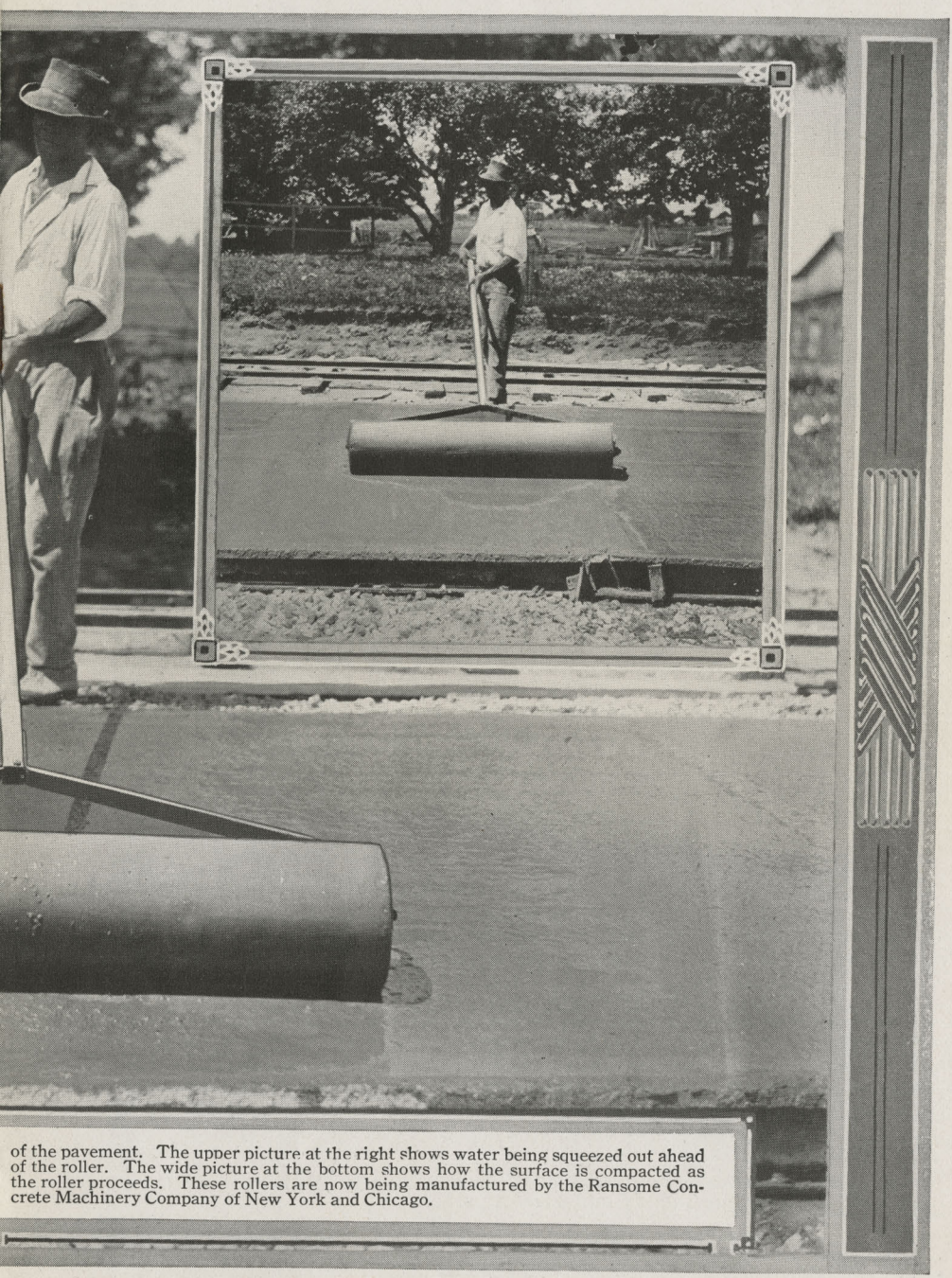
The Camera on the Job

Latest Methods in the Construction of Concrete Pavement Told in Pictures

THE ABOVE VIEW at Hammonton, N. J., shows the "ponding" method of curing a concrete street. The concrete is covered with water which is retained by earth dams built along the edge and across the pavement. This method produces a pavement which is probably superior to one cured by an earth covering. It is more economical, especially where it is difficult to secure the earth for covering, as the labor involved is less, especially when the earth covering must be removed after the pavement is cured. If the pavement is "ponded," it is but necessary to break the dikes, thus releasing the water, the only labor involved being that necessary to clean off what remains of the dams.



The roller method of finishing concrete roads is being taken up by road engineers everywhere. The above views were taken in Vermilion County, Illinois, where 144 miles of concrete road are being built under the direction of P. C. McArdle, Superintending Engineer. The upper picture at the left shows how the roller is used for the full width



of the pavement. The upper picture at the right shows water being squeezed out ahead of the roller. The wide picture at the bottom shows how the surface is compacted as the roller proceeds. These rollers are now being manufactured by the Ransome Concrete Machinery Company of New York and Chicago.

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Insuring Maximum Strength of Concrete

It is poor business to build with concrete and not take the necessary precautions to insure maximum strength. Good concrete can be made without difficulty if a few simple rules are followed.

Good aggregates, water not to excess, and proper mixing, are necessary. In addition, particularly in concrete road work, careful attention should be given to curing; that is, that the concrete shall not be permitted to dry out too fast and not be put into use before it has gained sufficient strength to carry its loads safely.

It is especially important during hot, dry periods that newly laid concrete shall not remain exposed to sun and wind. When it has hardened sufficiently, it should be covered with a canvas and kept wet. As soon as sufficient hardness has been attained by the concrete, the canvas should be removed and the pavement covered for two or three inches in depth with sand or earth and kept moist for seven to ten days, after which it should be allowed to dry out for a period not less than ten days before traffic is permitted to go upon it.

Most cities have ordinances providing penalty for using a street that is under construction before it is thrown open to traffic. All cities should enforce these ordinances as is done in New Castle, Pa., where a driver was arrested recently for driving upon a concrete pavement before the specified time had elapsed for opening it to traffic.

The injury that may be done by a heavy load to newly laid concrete is not always immediately apparent, and, in fact, there is often no surface indication at first to show that any harm has resulted. But after the pavement has been in use for a few months and repeated heavy loads have gone over it, the weakened condition of the concrete is disclosed and makes expensive repairs necessary.

Engineers should insist upon good aggregate, water not to excess, proper mixing and careful curing.

Concrete on Illinois State Aid Route No. 8, in Williamson County

Effect of Single Track Pavement in Center of Concrete Roadway

THE accompanying photograph is a good argument against the location of a single track pavement in the center of the roadway, says P. B. Wilson, County Superintendent of Highways of Williamson County, Ill. The slab is 10 feet in width with an earth shoulder of the same width on each side. The photograph was taken after a slight shower and shows that although the rain was not sufficient to affect the earth shoulders, the accumulation of water along the edges of the slab was sufficient to cause the formation of ruts, making proper maintenance of the earth shoulders both difficult and expensive.

Another illustration showing how a good brick pavement may be ruined by failure to build upon a concrete foundation. This street is in Wilmette, Illinois. Note how the pavement has broken away and is settling below the curb

Sheridan Road, Fort Sheridan, Illinois

Concrete on Government Roadways

THE above roadway, Sheridan Road, in Fort Sheridan, Ill., one of the leading military posts in the United States, has been paved with concrete by the United States Government. The length of this road is one mile, with a width of 18 feet. The work was done by C. P. Moran of Waukegan, Ill., and inspected by the Ohio Engineers now in camp. Josiah L. Rice of Fort Sheridan superintended the work. The funds used were a part of the $20,000 appropriation by special act of Congress. This stretch of road is at the south end of the military reservation and includes 1,050 feet on Walker Avenue running from the Lake to the entrance of the reservation.

"Concrete Lumber" for New Union Pacific Snow Sheds

"CONCRETE LUMBER" is the material being used by the Union Pacific Railroad in the construction of snow sheds at Rock River and other points in Wyoming. It is really not a stretch of imagination to call this material "concrete lumber" for the reason that the concrete is being prepared in slabs, some of them 3 by 6 feet and others 3 by 15 feet in size. With the exception of a reinforced rim around the edge, these slabs are only 2 or 2½ inches thick. The slabs will be fastened to the frame work in much the same way that lumber is attached to studding.

This is the first time in the history of American railroading that material of this character has been used for snow sheds and it is being watched with much interest. The material is known as "UNIT BILT" construction and the structures are being erected by the Houghton Construction Company of San Francisco, under the direction of W. R. Armstrong, Engineer Maintenance of Way of the Union Pacific Railroad Company, at a total cost of approximately $1,000,000. At Rock River the snow sheds are to cover three tracks.

Our Cover Picture

THE cover picture on this issue of our magazine is of the concrete road between Monroeville and Norwalk, in Huron County, Ohio. This was built in 1914 by the Modern Construction Co., Fremont, Ohio, under the supervision of the county highway engineer.

Permanent Road Building in Contra Costa County, California

By R. R. ARNOLD, County Surveyor

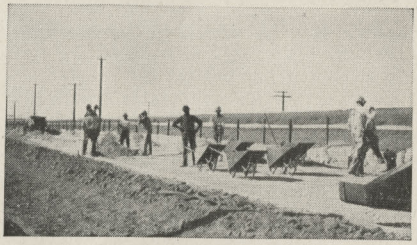
IN 1915, Contra Costa County adopted a system of road construction by which it was planned to build approximately ten miles of permanent road per year, and continue until all the main highways, a total of seventy-five miles, have been built. The money for this work comes from the General Fund and is provided for by a special levy of twenty-five cents on each one hundred dollars of valuation in the county.

In 1915 we contracted for 3.01 miles of pavement, 18 feet wide, and in 1916 we built 7.25 miles and contracted for an additional 10.63 miles. The accompanying illustrations are from this last contract, which is now under way and about completed.

We are using some methods which seem to be somewhat original and thinking that they might be useful to other engineers we gladly pass them on.

Sub-Grade

We feel that the sub-grade is one of the most important features in the construction of a permanent concrete road and therefore give it a great deal of attention and care. The greater part of our roads are in a comparatively level country although we have some fills as deep as six and ten feet. In all our fills of more than one foot we use the method of building in layers one foot in thickness. Each layer is placed and well watered before the succeeding layer is placed. By well watered I mean dyked and flooded. While the water is still on and as soon as the stock can travel on it we place the succeeding layer. When the final grade line is reached the fill is allowed to stand until it will support a roller of not less than ten tons. In all cases where the cut or fill is less than one foot the entire width of the roadway is broken up for a depth of at least six inches before being brought to the required grade, after the road is brought to an approximately true grade it is so well watered for the entire width that no dry earth can be found above the undisturbed roadbed. This watering is done with a hose and great care is taken to see that it is uniform. The next step is to roll with a ten ton roller as soon as the road will support it. The entire cross-section of the road from shoulder to shoulder receives the same treatment up to this point. After this rolling, which is thorough, the header boards or forms are placed. We use 2 x 6 inch Port Orford cedar, 16 and 18 feet long. We next go over with a Carr leveler which indicates the high and low spots. After the subgrade is now brought to the final and true grade and watered, it is ready for the final rolling. As it is impossible to roll closer than two or three inches of the side forms we use a hand tamp for that part.



Materials

We have used nothing but creek gravel on our work to date because it is cheaper than stone and is of an excellent grade. Our sand is exceptionally clean, hard and well graded.

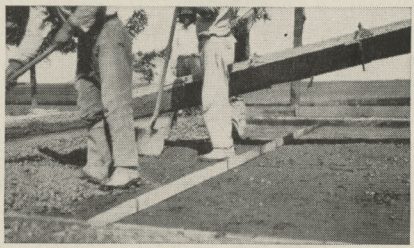
There is an excuse for sometimes using an inferior grade of material, but there is no excuse for not having that material clean and uniform as to grading. We absolutely refuse to accept it if it is not standard.

Mixing and Placing Concrete

As we were not so well organized at the time of doing our first work in 1915, these methods referred to in this article apply more particularly to the work of the last year.

We believe in and take great care in securing a uniform mix at all times. Our early experience proved to us that it is almost impossible to secure such results with the ordinary rock wheelbarrow and we are now using a special

type. It is so built that it holds just three cubic feet when level full or when struck off with a shovel handle. We have an assistant inspector whose only duty is to count the wheelbarrows and sacks of cement. We find that he never has to argue with laborers about the amount of aggregate in wheelbarrows as he did when using the old style. We absolutely stick to the one minute mix and a standard amount of water. The mixer operator has a watch hanging in



front of him by which he times every operation. It can be done and we not only expect it but get it.

We use just enough water to give a workable mix and never enough to cause the mortar and aggregates to separate. We are using a "Foot" mixer making a three sack mix.

Our experience is that it is hard to always secure a good floater and we have been compelled to find some other way to secure a satisfactory surface. By a method which we developed last fall we now do away with any use for a hand float on the job. We use the regulation heavy screed, made of a 4 x 8 inch oak plank, shod with iron and car-

rying plow handles at the end, to spread, tamp and smooth with. This leaves a very true surface ready for our finishing template is made of a 2" x 12" plank, shod with iron and carrying plow handles at each end the same as the first screed. The first screed should be cut to a slightly higher crown in the center than the desired crown and the finisher to the true crown, and a slight bevel given to the bottom so as to throw excess moisture ahead on the road surface. This throws extra concrete to the center and allows for some flattening before the second or finishing template comes along. The finishing template is used by lifting it up from the surface about 4 or 5 inches and dropping. By using care the corrugations can be put any distance apart and a perfectly true surface can be made. If the side forms are true to grade this system will leave a surface absolutely free from any wavey condition, which is a fault so easy to make in a pavement.

We have about seven miles of plain concrete and are building with the idea of doing away with the expense of a covering of any kind. We also have ten miles of carpeted roadway and the public, both automobilists and rounders, prefer the bare concrete. We plan to let a contract for ten additional miles of plain concrete 18 feet wide this year using this same specification.

Street Widening Procedure in Wisconsin

S. J. WILLIAMSON, Building Inspector of the State Industrial Commission at Madison, Wisconsin, summarizes in the *Engineering News Record,* the recent law in regard to street widening procedure, enacted by the last session of the Wisconsin legislature. This provides that if the council decides to widen a street, a jury must be convened to take action thereon, as in other condemnation proceedings; but after such action, if buildings are located on a part or all of the land to be taken, then the city may at its discretion take over such land at once, paying the necessary damages; or may wait until the building is torn down and then take over the land without paying for the building.

As soon as the jury's verdict is entered confirming the necessity for widening the street, it immediately becomes unlawful for any person to build upon the land to be thus taken, or to increase the height of any existing building on such land; and if anyone does so build, he must remove his building without cost to the city, when the latter is ready to buy the land.

Repair of Concrete Pavements: Cracks and Joints

By A. H. HINKLE
Deputy Highway Commissioner of Ohio State Highway Department

CLEAN the crack or joint of all dirt, manure or other foreign matter. This cleaning can be done by the use of an iron hook and brooms. Use wire or rattan push brooms, finally removing the fine dirt by sweeping with house brooms or the use of compressed air. A heavy tire pump may be used for this purpose although this refinement in cleaning may not be necessary. When the crack is clean and dry it may be filled by one or both of the following methods:

Method (a). For small cracks and joints.

Fill crack or joint full with hot tar, permitting the tar to lap over the spalled edges of the crack, but *not to exceed one inch.* The tar should be hot enough to run readily into the crevices of the pavement (200 degrees to 250 degrees F.).

Great care should be taken that the tar is not injured by overheating. It should never be brought to a temperature where yellow fumes will be given off. Long continued heating at a low temperature will be injurious. For this reason the tar in the bottom of the kettle should be cleaned out occasionally and thrown away. Tar which has been injured by overheating becomes hard and brittle when it cools. Such tar will spall off and chip out of the crack. It will have a very temporary life and be of little service in protecting the edges of the crack or joint.

The tar should be poured from a can with a narrow spout. Immediately after pouring the hot tar, cover it with dry sand or screenings. If sand is used, it should be clean and preferably coarse. If screenings are used, they should consist of No. 6 (½" to $\frac{3}{16}$") grit of stone, slag or gravel. If upon cooling, the tar drops below the surface of the pavement, the crack should be refilled, as the secret of this method of maintenance is to keep the crack or joint full. No large excess of tar should be used, however, as it will eventually build up an elevation on the surface which is objectionable to traffic. The covering of screenings or sand should be put on immediately after pouring the tar so that while in the liquid state it will unite with the screenings or sand. This will prevent the tar from sticking to wheels of vehicles or melting during hot periods and running from the cracks. The sand or screenings should be swept back onto the tar, or new sand added, one or more times after it is first applied. This should be done when the tar is soft during hot weather and at such times as the weather and traffic conditions will demand it. During very hot weather this recovering will usually be required within a week or ten days after the tar is poured. During cool weather a much longer period will intervene. If the tar has been poured late in the fall, additional covering may be needed during the first hot periods the following spring.

Instead of using pure tar as described above, a better method, if properly done, consists in using a mixture of hot tar, T-1, and fine dry sand. Fill the tar pouring can about one-half full with the hot tar. Sift from one-half to an equal amount of dry sand into the tar, stirring same as the sand is added. Pour the tar mastic thus produced into the joints or cracks the same as the pure tar is poured, and cover with sand or screenings. This whole operation should be done rapidly so that the tar mastic will not become cold and stiff before it is poured. If the sand is damp or the weather is quite cool, it will be necessary to first heat the sand. Only a small amount of moisture in the sand will cause the tar to foam. The advantage of using the mixture of tar and sand lies in the fact that it will not melt and run from the crack during hot periods as badly as will the tar when used alone. For this reason it is *especially valuable to use on steep grades.* The amount of sand that can be successfully used in this way will be found by experiments. The amount of sand should never exceed the amount of tar. Any small amount of sand will aid in keeping the tar in place. Use only such portion of sand as will permit the easy pouring of the mastic (tar and sand mixed together).

Method (b). For large cracks and joints.

Paint the edges of the crack or joint with tar to a depth of one inch or more and back sufficiently far on the surface as to completely cover all spalled edges.

For this purpose there may be used hot tar, T-1, H. T. 0 1, or the cold tar, T. C. B. (tar cut back). Fill the cracks and joints with bituminous concrete prepared as described below. A sufficient quantity should be used to fill the crack to the level of the surface of the surrounding pavement when thoroughly compacted. After the bituminous concrete is *thoroughly rammed* into the crack, compacted with a *tamping iron,* and made to *conform to the adjacent surface* of the pavement, cover it with coarse sand or No. 6 (½″ to $\frac{3}{16}$″) grit of stone, slag or gravel, to prevent the bituminous material from sticking to the wheels of vehicles and hoofs of animals. This covering should be about ¼″ thick.

Bituminous Concrete for Method (b) above shall consist of an intimate mixture of clean No. 4 (¾″ to ¼″) stone chips and tar, T. C. B., mixed cold and in the proportions by volume of about 11 parts of stone chips to 1 of tar. This tar is liquid at ordinary temperature so that it is unnecessary to heat the tar.

Partners—not Competitors—in Transportation

AS heavier rails met the weight of greater traffic at higher speed on railroads, so concrete is solving the same problem in heavier tonnage and faster vehicles on country highways. The evolution of transportation is here typified in these two types of road—concrete and steel. In both types the science of engineering has attained a high degree of efficiency, insuring safety, speed, comfort and durability. The concrete road is the logical ally of the railroad. This particular stretch of highway is on the San Francisco-Eureka route near Healdsburg, Cal.

The stone chips should be clean and dry. The chips are spread thinly (3″ to 4″ deep) on a platform or the smooth pavement, and the tar sprinkled uniformly over them from an ordinary water sprinkling can with the holes in the rose slightly enlarged. The chips and tar are then mixed with a shovel as in mixing cement concrete, turning the mixture a sufficient number of times, depending on the temperature, to coat every piece of stone with the tar. (This will usually require at least six times.) The mixture is then shoveled into a pile where it will be reasonably free from dust and dirt and permitted to stand from four to seven days until the bituminous mixture cures (stiffens sufficiently to properly bind when tamped into the crack). If left exposed to the air the mixture will usually be suitable to use for a period of a week or more after it is cured. If covered with a tarpaulin or other suitable cover, it may be kept in a condition suitable for use a considerable length of time. If it is desired to fill quite small cracks with this mixture a *smaller sized screening should be used.* If a quite large opening or hole is to be filled a larger stone should be used. When the larger stones are used the stone should be graded in size from the largest to the smallest size here mentioned. A small portion of clean coarse sand may be added to the stone to good advantage. The sand, however, must be clean, sharp, and not too fine, or otherwise it better be omitted from the mixture.

The following are suggested as necessary implements for this work:

1 100 gal. tar heating kettle for heating the tar.

1 thin iron hook for cleaning the joints.

4 short handled square point shovels.

1 pick.

2 wheelbarrows.

1 3 gal. tar pouring can with conical or vertical spout.

1 3 gal. tar pouring can with rose.

2 wire push brooms.

1 house broom.

1 concrete tamper (6″ or 7″) either square or round.

2 galvanized iron pails (3 or 4 gal.).

1 tamping iron not more than ½″ wide.

A wagon loaded with sand and to which tar kettle is hitched will ordinarily be used on large jobs. In this case 5 or 6 men will be required. On small jobs

and where but two or three men are to be employed, the tar kettle may be pulled by hand and the sand wheeled from piles at the roadside. The number of tools can be reduced in proportion to the number of men.

When using the bituminous concrete, the wagon will carry a portion of a load of this material and a part of a load of sand. Also, if the painting is done with the tar, T. C. B., this material will be carried in a barrel or wagon. The tar can be drawn from the barrel by means of an oil gate or dipped from the open barrel. If the painting is done with the tar, T-1, or H. T. 1, it will be heated in the tar kettle which will be hauled behind the wagon. If but a small force, say 2 to 4 men, are working, a one-horse wagon should be sufficient.

(1) The tar shall be homogeneous, and free from water, and shall not foam when heated to 149° C. (300° F.).
(2) Specific Gravity, 25° C./25° C.— .....1.20 to 1.27
(3) Float Test at 50° C.— .....2 to 3 min.
(4) Total bitumen (sol. in CS_2)— .....78% to 90%
(a) Inorganic matter insoluble— not over..... 0.5%
(5) Total distillate by weight:
To 170° C.— not over..... 0.0%
To 270° C.— not over.....10.0%
To 300° C.— not over.....20.0%
Melting point of residue— not over.....70° C.
Specific Gravity of distillate 25° C./25° C.—not less than.....1.03

BITUMINOUS MATERIAL H. T-1.

Bituminous Material H. T-1 shall include only coal tar products which shall meet the following requirements:

(1) The tar shall be homogeneous, and free from water, and shall not foam when heated to 135° C. (275° F.).
(2) Specific Gravity, 25° C./25° C.— .....1.18 to 1.25
(3) Float Test at 32° C.— .....2 to 3 min.
(4) Total bitumen (sol. in CS_2)— .....80% to 90%
(a) Inorganic matter insoluble— not over..... 5%
(5) Total distillate by weight:
To 170° C.— not over..... 1.0%
To 270° C.— not over.....16.0%
To 300° C.— not over.....24.0%
Melting point of residue— not over.....70° C.
Specific Gravity of distillate 25° C./25° C.—not less than.....1.03

BITUMINOUS MATERIAL M. T.

Bituminous Material M. T. shall meet the following requirements:

(1) The tar shall be homogeneous and free from water.
(2) Specific Gravity, 25° C./25° C.— .....1.12 to 1.18
(3) Specific Viscosity at 40° C.— ..... 25 to 35
(4) Total bitumen (sol. in CS_2)— ..... 88 to 95%
(a) Inorganic matter insoluble— not over..... 0.5%
(5) Total distillate by weight:
To 170° C.— not over..... 5.0%
To 300° C.— not over.....28.0%
Melting point of residue— not over.....65° C.

BITUMINOUS MATERIAL T. C. B.

Bituminous Material T. C. B. shall meet the following requirements:

(1) The tar shall be homogeneous and free from water.
(2) Specific Gravity, 25° C./25° C.— .....1.15 to 1.20
(3) Specific Viscosity at 40° C.— ..... 10 to 30
(4) Total bitumen (sol. in CS_2)— ..... 85 to 92%
(a) Inorganic matter insoluble— not over..... 0.5%
(5) Total distillate by weight:
To 235° C.— not less than..... 15%
To 300° C.— not over..... 35%
Melting point of residue— not over.....70° C.

Massachusetts Lets Highway Contracts on Basis of Costs Plus Fixed Sum

By A. W. DEAN
Chief Engineer of the Massachusetts Highway Commission

THE Massachusetts Highway Commission has let about five contracts on the basis of cost plus a fixed sum per unit, the idea being to get the work done at as reasonable a cost as possible without the element of chance that would necessarily enter into the matter if a contractor were to bid on the work in the usual manner. Contractors have been refraining this year from bidding on contracts to a considerable extent, and where a bid has been submitted, it has been made high in order that the contractors might be sure that the increase in cost of labor and material would not mean a loss to them.

On the first contract that we let on this basis this year we allowed the contractor the cost plus the following sums:

Earth excavation (dry)..$0.06 per cu. yd.
Ledge excavation..... .14 " " "
Local broken stone..... .12 " ton

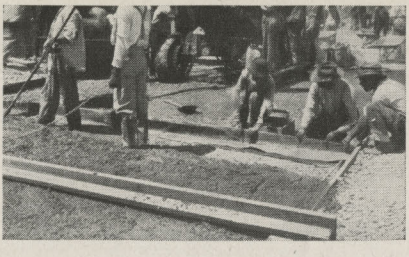
And other items in proportion, the contractor being required to furnish the necessary superintendents, foremen, laborers, etc., at compensation agreed upon between the contractor and the Commission, the Commission paying the actual sum paid by the contractor to such persons as shown by the contractor's time-books and checked by a timekeeper employed by the Commission.

The contractor is required to furnish all small tools and implements such as picks, shovels, hammers, wheelbarrows, etc. Machinery is either furnished by the Commission or by the contractor on a rental basis, the rental being agreed upon in the contract.

There is no inducement to the contractor to make the cost of the work excessive. On the other hand, there is every inducement to him to get the work done as quickly as possible, and consequently, at low cost, in order to make his profit as quickly as possible. If there is a $5,000 profit to the contractor in the contract, he would rather make that profit in two months than have the work extend over eight months.

I cannot see how there is any public risk in letting this type of contract, provided the supervision is controlled by the commonwealth or municipality.

Kinks for Concrete Road Builders



Installing Tar Paper Joints

TO install tar paper joints on concrete roads being constructed in Dallas County, Texas, a piece of heavy sheet steel was cut to the exact cross section of the road and the tar paper folded around it and firmly braced with iron stakes as shown the photograph. After the concrete had been placed on both sides of the joint, trap rock was spread on the surface and vibrated (this particular work is vibrolithic), the top of the paper was cut and the metal plate removed.

Opposes Hardener for Concrete

H. J. Kuelling, Assistant Engineer of the Wisconsin Highway Commission, formerly Highway Commissioner of Milwaukee County, Wisconsin, in the July number of the Road Maker, replying to the question as to whether he believes any of the patented concrete hardeners are justifiable in highway work, says—

"The writer has examined a good many of these and used a few in experiments. He has yet to be shown that they are of any particular benefit to the road. Concrete properly made does not require any hardener."

Method of Cutting Off Joint Fillers

JOINT filler should be trimmed so as to leave about ½" of the material extending above the pavement. This surplus is ironed down by the traffic and forms a better joint than if cut off flush with the concrete. An economical way of cutting off this filler is shown by the accompanying photograph. Two steel cleats on the underside of the shovel allow it to ride about ½ in. above the surface of the pavement leaving a uniform surplus extending above the road.

Now is the Time to Use

CONCRETE

War Bulletin No. 2 of the Chamber of Commerce of the United States Says:

"Iron and steel should be used only when the requirement is unavoidable. Every effort should be made to use wood and concrete in place of steel whenever this can be done, and construction and development work requiring steel should be postponed wherever possible . . . . cement may be had in quantity for concrete work."

Says Cass Gilbert, the New York architect:

"There are hundreds of buildings erected in this country every year which could be just as well erected without steel, and in hundreds of others the amount of steel could be greatly reduced. An enormous tonnage could be saved if reinforced concrete, masonry or other material were used. Practically all buildings of moderate height can be erected without the use of large quantities of structural steel. Reinforced concrete or old-fashioned masonry can take its place."

Under present conditions concrete is particularly desirable. All the materials—portland cement, sand, pebbles or crushed stone—are staple products, most of them obtainable near by. Concrete is made with ordinary labor under skilled supervision. Concrete contractors have developed rapid and efficient methods of construction. There are many engineers, architects and contractors who specialize in concrete construction. If necessary we can help you get in touch with them.

CONSIDER THE ADVANTAGES OF CONCRETE—

Fireproof	*Verminproof*	*Rigid*
Watertight	*Sanitary*	*Rapidly Built*
Durable	*Weatherproof*	*No Repairs—No Painting*

Concrete is used today more generally than ever before. The smallest job on the farm and the largest engineering works are built of concrete. Use concrete to build that factory, foundry, shop, warehouse, bridge, tank or reservoir for storing liquids, coal pocket, ore bin, grain elevator, garage—any building you are planning.

Let us send you an interesting pamphlet, ***"Why Build Fireproof?"***

PORTLAND CEMENT ASSOCIATION

ATLANTA DALLAS KANSAS CITY PITTSBURGH SEATTLE
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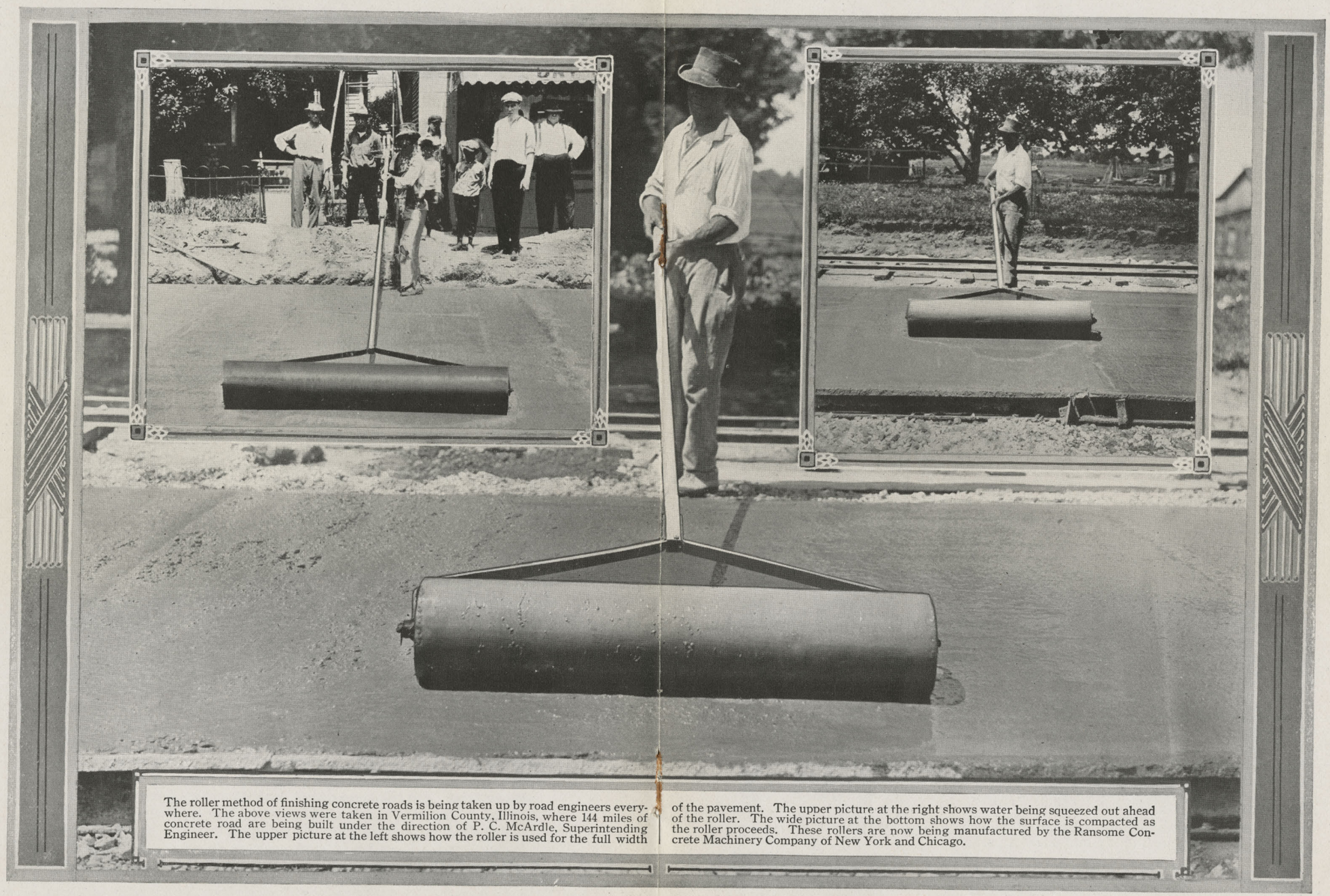
CONCRETE FOR PERMANENCE

CONCRETE HIGHWAY MAGAZINE



The roller method of finishing concrete roads is being taken up by road engineers everywhere. The above views were taken in Vermilion County, Illinois, where 144 miles of concrete road are being built under the direction of P. C. McArdle, Superintending Engineer. The upper picture at the left shows how the roller is used for the full width of the pavement. The upper picture at the right shows water being squeezed out ahead of the roller. The wide picture at the bottom shows how the surface is compacted as the roller proceeds. These rollers are now being manufactured by the Ransome Concrete Machinery Company of New York and Chicago.